Tell Me How You Gaze at Strategy Tools and I Tell You How You Decide

Abstract

Strategy tools are frequently used in organizations and extensively taught in educational institutions. However, the real impact of strategy tools in practice is still uncertain. In addition, strategy tools can also introduce misunderstandings and are by no means guarantees for establishing shared meaning. This study analyzes the gaze behavior, i. e., eye movements, of 91 decision makers. Therein, it is determined that the gaze of decision makers carries significant predictive value for the actual decisions made and is closely linked to the cognitive processing of the decision makers. These results establish eye tracking as a viable method for analyzing the individual interpretation of strategy tools by users and contribute to an under-represented area of strategic management research. The authors raise awareness to the importance of the gaze on information processing and provide ideas on how those insights can be used to establish shared meaning in organizations.

Keywords: *Strategy tools, strategy process, decision-making, eye-tracking methodology, cognitive processing*

1. Introduction

Strategy tools are defined as numerous techniques, tools, methods, models, frameworks, approaches, and methodologies which are used to support decision-making in strategic management (Clark, 1997), are an integral part of strategic management as a field (Paroutis et al., 2015) and can bridge the gap between theory and practice (Moisander and Stenfors, 2009). They can be both process tools, such as project management techniques and environmental analyses tools, and physical tools, such as computers and documents (Stenfors et al., 2007). Examples of strategy tools are portfolio analysis models, core competencies, or the Balanced Scorecard (Knott, 2006). The applications of strategy tools are plentiful (e. g., Knott, 2006; Rigby, 2013). Companies seem to use on average twelve strategy tools (Rigby, 2001). Furthermore, they are an important subject in strategic management teaching at higher educational institutions (Hill and Jones, 2012; Jarzabowski et al., 2013; Johnson et al., 2008; Tapinos et al., 2011; Wright et al., 2013) and strategy workshops (Hodgkinson, 2013; Johnson et al., 2008; Paroutis et al., 2015).

Despite this extensive use of strategy tools in practice, literature, and teaching, there seems still to be little insight on how strategy tools are actually used by decision makers in practice and on what the consequences of their applications are (Armstrong and Brodie, 1994; Healey et al., 2013; Spee and Jarzabkowski, 2007; Tapinos et al., 2011). Recent research tries to understand the impacts of the application of strategy tools on the resulting strategy, for instance, the impact of strategy workshops (Bourque and Johnson, 2008; Healey et al., 2013; Hodgkinson, 2013; Jarratt and Stiles, 2010; Johnson et al., 2008). Furthermore, even though strategy tools provide a common language for a discourse on strategy (Barry and Elmes, 1997; Spee and Jarzabkowski, 2011), the tools do not necessarily indicate shared meaning of the decision makers, specifically between different hierarchical organizational levels (Grant, 2003; Salih and Doll, 2013). This hints towards an inconsistency in the interpretation of strategy tools. Knott (2006) suggests in his typology of strategy tool application, to focus on the interpretation of strategy tools by different users and not to follow the common textbook approach. To better understand the challenges when applying strategy tools, research has to address how decision makers approach and utilize such tools. Much research has been conducted to understand how both the competence to read and write develop and how systematic education can enhance these abilities (Flesch, 1948). We strive to open up this discussion for strategy tools.

In our pilot study, we aim to provide insights into the individual interpretation of strategy tools by decision makers. The method discussed in this paper is eye tracking. Eye tracking has made significant contributions to a more comprehensive understanding of human reading and information processing behavior (Rayner et al., 2001; Schnitzer and Kowler, 2006) and could hence generate insights into decision-making based on strategy tools as well. The question we ask is, if the gaze behavior of decision makers provide insights for the actual decisions they make. The results of this paper show that the gaze of decision-makers is closely associated to decision-making. Therefore, the analysis of gaze behavior helps to understand the decision-making of strategy tool users. The insights can be used in practice to establish shared meaning on the implications of the used strategy tools.

2. Literature review

Strategy tools are an integral part of strategic management as a field (Paroutis et al., 2015). This importance is also represented in literature. Literature on strategy tools usage in organizations (e. g., Rigby, 1993; 2001, 2013), workshops (e. g., Hill and Jones, 2012) and teaching (e. g., Hodgkinson, 2013) are widespread. Nevertheless, practicing managers consider their satisfaction with the used tools only as being moderately positive (Rigby, 2013). One reason for this seems to be that 82% of the respondents of Rigby’s survey feel that the tools promise more than they actually deliver (Rigby, 2001). It is reasonable to assume that the high promise stems from the frequent application of the tools in practice, workshops, and teaching.

But why does an overwhelming majority of the users in practice think that the tools fail to deliver?

There seems to be a discrepancy between how strategy tools are supposed to work and the results they produce in a practical environment. A more in-depth investigation of the consequences of strategy tool application has already been demanded (Armstrong and Brodie, 1994; Healey et al., 2013; Spee and Jarzabkowski, 2007; Tapinos et al., 2011). The individual approaches and interpretations of strategy tools seem to be a characteristic which is mostly taken-for-granted in literature and practice (Knott, 2006). Exactly those taken-for-granted aspects of strategic management should be examined critically (Vaara and Whittington, 2012). The goal is to shift the focus of research from the textbook explanations to the actual use of strategy tools by practitioners (Spee and Jarzabkowski, 2009). Knott (2006) argues similarly and suggests in his typology that further research is necessary about decision makers' adaption of tools, which is arguably under-represented in the literature relative to its practical importance. In this process of adaption of a tool to the understanding and decision-making of a decision maker, the role of the gaze is important for several reasons.

The gaze behaviors point to the current focus of interest in the environment of a decision maker (Conty et al., 2007; Hodgetts et al., 2015; Lee and Ahn, 2012; Quigley et al., 2012; Rayner, 1998), are associated with cognitive processing (Ellis et al., 2011; Hayhoe and Ballard, 2005; Kaller et al., 2009; Liversedge and Findlay, 2000; Rayner, 1998) and can provide insight into one's mind, such as the individual processing of information (Ballard et al., 1997; Just and Carpenter, 1980; Proctor and Vu, 2006). Eye tracking measures gaze positions and movement to reveal what individuals are looking at (Yang and Wang, 2015). The eye-tracking hardware follows the physical movement of the eye of the participants and the software converts those physical movements into coordinates and matches them to objects on the screen (Petrusel, 2014). The practice of analyzing the movement and behavior of one's eyes are becoming a common application in business today (Yang and Wang, 2015). However, most business-relevant research with eye tracking is conducted in marketing (Pieters and Wedel, 2004; Purucker et al., 2013; Wästlund et al., 2015) or web design (Cyr et al., 2006; Wang et al., 2014); not in strategy research. The analysis of visual attention of users of strategy tools has already been studied in a workshop setting where the directions of the gazes of the participants had been observed (Paroutis et al., 2015). The authors relied on video tapings and observations to determine the gaze directions of managers. In contrast, the research presented in our paper uses quantitative data, collected with eye tracking and focuses on individual decision-makers and not smaller groups' interactions as Paroutis et al. (2015) did. Hence, the idea is similar, yet the implications differ since the methods applied are fundamentally different.

Eye movements can be classified into three groups: Spontaneous looking, task-relevant looking, and orientation of thought looking (Kahneman, 1973). Despite the strong link between gaze behavior and cognitive processing, there is also a possibility that participants are looking at an information without cognitively processing that information (Barber and Legge, 1976; Snyder, 1973). To limit this effect, Just and Carpenter (1976) advice to make the content of the interface relevant for solving a task, instead of simply letting participants look at something. Cognitive processing refers to the process of thinking, which is assumed in this study to be strongly associated with a specific decision made.

Hypothesis 1: The gaze of the decision makers on strategy tools can predict the actual decisions made.

Strategy tools can approach a decision maker in many different forms, including matrices and text form (Knott, 2006). Further, the analysis of the tools used by companies show changing frequencies of application rates of certain tools (Rigby, 2013, 1993). Hence it is paramount for the implications for practice to evaluate the gaze behavior of decision makers based on different representations of strategy tools. The use of different stimuli for analyzing the potential different effects on cognitive tasks is widespread. As an example, Crowe et al. (2000) analyzed cognitive challenges of participants while solving maze problems and used various different designs and complexity levels of the maze problems.

Hypothesis 2: Different depiction of strategy tools influences the predictive value of the gaze of the decision maker for the actual decision made.

Hypothesis 3: Different amount of information displayed in strategy tools influences the predictive value of the gaze of decision maker for the actual decision made.

Figure 1 shows our hypotheses in a conceptual model.

<<< insert Figure 1 about here >>>

3. Research Design

Sample. The sample consists of 91 participants. All of those participants are students at the business school at XXX-University. Due to their studies and activities in the field of management and strategy, all participants are familiar with the stimuli shown and strategy tools in general. Our control variables were the age of the participants, the number of years of work experience, and the GPA of the current or most recently finished study program. The motivation of the participants to take part in the experiment was that they had to successfully participate in order to complete one advanced study course.

Stimuli. The BCG portfolio matrix (hereafter BCG) (Henderson, 1970) and the Business Model Canvas (hereafter BMC) (Osterwalder and Pigneur, 2010) were used for the experimental setting in our study. The BCG allows for decisive decisions with regards to investment strategy based on its graphical representation (Masarova and Krizanova, 2013; Shi and Shi, 2010; Wang et al., 2013; Zhou and Zuo, 2010), which fits the purpose of our study. Furthermore, the BCG is one of the most successful tools in strategic management (Rigby, 2001; Shi and Shi, 2010) and its application is widespread (Morrison and Wensley, 1991). The BMC is, given its date of invention, already an established method (Axelsson et al., 2014) and one of the most popular frameworks for the design of business models (Iacob et al., 2014). Its application is largely text-based by the recommended use of post-it notes (Osterwalder and Pigneur, 2010), which creates a different setting compared to the BCG, which relies heavily on design measures, such as placement and size of content. The BCG was applied to the fictional business case Milk Inc., whereas the application of the BMC was based on the author's own representation of the business model of Apple Inc. The participants were asked to make decisions based on multiple-choice questions on the business case applications of the tools.

The stimuli was based on a Power-Point presentation; single media pages were displayed to the participants. First, the participants had the opportunity to learn the blank model, followed by the business case application of either tool, before the participant had to answer the questions. The order of the media pages was not randomized since they built on each other. We used two sets of stimuli of each strategy tool. Each set of stimuli consisted of one version of the aforementioned strategy tools. The difference between stimuli set #1 and #2 was the orientation of the scales on the X-axis in the case of the BCG (Hypothesis 2) and the amount of details provided in the case of the BMC (Hypothesis 3). Each participant was randomly allocated to one set of stimuli. The decisions the participants had to make remained unchanged and the initial position for success were not affected by the changes in the versions.

Experimental setting. The hardware used was a Tobii X2-60 eye tracker with a sampling rate of 60 hertz which was calibrated to the participants using a five-point calibration (Morimoto et al., 2000). The stimuli was displayed on a 22 inch PC-widescreen with a resolution of 1680x1050 pixels (e. g., Buscher et al., 2010). The data was recorded and matched to the stimuli by the corresponding software Tobii Studio 3.3©. The stimuli were launched from a notebook while the participants were sitting directly in front of the PC-screen. A chair without wheels was chosen to reduce movement. A regular PC keyboard was installed below the screen. With the button "F10", participants were able to advance from one media page to the next before the predetermined timeframe ended. Hence, participants were asked to forward to the next page as soon as they had answered the question of a media page. To answer a question, the participants indicated their perceived correct answer orally. This way, the participants were able to keep the eyes constantly on the screen, which improved the sampling rate. Oral questions by the participants during the tests, for which answers would have rendered an advantage, were ignored to promote equal treatment. The entire test sequence lasted for approximately 18 minutes, including further stimuli which are subject to future research. Figure 2 shows the setup of the research lab.

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Measures. In our study, we asked the participants multiple choice questions on the business case applications of the strategy tools. Based on the gathered gaze data, the authors predict the actual answer given by the participants based on three measures. Hence, we evaluated the predictive value of different gaze measures towards the actual decision-making (Hypothesis 1). The measures were calculated based on defined *Areas of Interest* (hereafter AOI) in the stimuli. AOIs are drawn directly on the interface of the stimuli and act as data collectors throughout the entire display time of the media. The collected data can then directly be analyzed in Tobii Studio or exported (Tobii Technology AB, 2012). Individual AOIs were drawn for every area of the tools which contained information for the readers. Using Heatmaps of the aggregated participants' gaze of every individual media page, the placement and size of the AOIs was determined. Usually, the AOIs were drawn bigger compared to the actual information given on the interface, to account for either fixations which were reasonably close enough to the specific information for reading or for slightly deficient tracking precision. For the analysis of the collected eye tracking data, a delay for latency of 200ms on every individual media page was used. This time frame is required for the participants to initiate a saccade, hence they are unable to process the information seen during this timeframe (Fischer and Ramsperger, 1984; Reuter-Lorenz et al., 1991; Zambarbieri et al., 1982). Therefore, it is reasonable not to consider these early fixations. Using the AOIs, three different measures were used to assess the hypotheses.

First, studies concerning with the effect of the gaze on decision-making have suggested that gaze allocation can represent prioritization (Armel et al., 2008; Shimojo et al., 2003). Hence, an area fixated first has an advantage in influencing decision-making due to the exposure effect (Simion and Shimojo, 2006). Krajbich et al. (2010), argue that first fixated areas have an advantage also due to the accumulation of evidence. Hence, predictions were made based on the measure first fixation. Based on the metric time to first fixation, which measures the amount of seconds until a participant fixates a certain AOI for the first time (Tobii Technology AB, 2012), the first fixated AOI while making a decision was defined as the expected answer. If one AOI was not fixated at all (hence rendering no time to first fixation), the other AOI was automatically assumed to be the expected answer, baring that the other AOI was fixated at least once. At the starting time of a new media page, usually the participants gaze was resting approximately in the middle area of the screen. Using the Gaze Plots, it becomes apparent, that the participants rather quickly made their way to first focus on the question on the bottom of the media page. While making this trail, the participants left some fixations over the available interface, which can also be located within an AOI. Hence, we analyzed fixations only after the decision maker has perceived the question of the individual media page to accurately assess decision making with this measure. Thus, the time required until 80% of the participants had fixated the question of a media page for the first time was calculated. This time ranged from 1.0 to 1.9 seconds. For every media page individually, the starting time for the analysis was defined according to the above mentioned calculation.

Second, while analyzing the gaze behavior in reading, usually the saccade size, fixation duration, and number of regressions are analyzed (Rayner and Pollatsek, 1989). Similarly to those studies, the same measures can be applied to strategy tools. The saccade size was disregarded, since it is largely dependent on the array of the chosen visual representation (Vlaskamp and Hooge, 2006) and hence better suited for text-based tasks. Our second measure was the duration of fixation. The amount of time fixated on an area is related to the required time for processing the information displayed in that area (Findlay and Gilchrist, 1998; Just and Carpenter, 1976). Since the area fixated is associated with the participants' focus of interest on the interface (Rayner, 1998), this measure can be used to portray perceived relative importance of the participant towards the information in that area. Hence, one could assume that decision-makers decide more favorable for the information of the area they fixated the longest.

And third, Rayner and Pollatsek (1989) also analyzed the number of regressions. With regression, the necessity of re-reading parts of the text due to insufficient information processing is understood (Rayner and Pollatsek, 1989). In this study, we refer to the regression as an increased amount of total visits on an area with information. A visit is defined as the time interval between the first fixation on an AOI and the end of the last fixation on the same AOI, where there have been no fixations outside of the AOI in between (Tobii Technology AB, 2012). Similarly to the total time of fixation, both measures can indicate challenges in information processing (Findlay and Gilchrist, 1998; Just and Carpenter, 1976) and higher perceived importance (Rayner, 1998) of the information displayed in the frequently visited areas.

4. Results

To assess the predictive value of the different gaze measures, only the media pages with questions that could be answered decisively, i. e., choosing a correct answer, were used.[1] Participants who chose to answer a question with the neutral answer option, where possible, were excluded from the analysis to focus on the decision makers who made a decisive decision based on multiple AOIs. Therefore, all analyses of predictive values are split into predictions for either three decisive answer options or two decisive answer options. The significances of correct predictions differ for these two scenarios. Finally, participants who opted for a “blind” decision were excluded from the definition of predictions as well. Those participants never fixated any of the AOI and relied for their answer probably primarily on mental models, guessing or even remembering content from previous media pages. Table 1 shows the number of predictions made, as well as the number of participants who answered a question either neutrally or blindly on every media page. Two participants who could not answer due to time constraints on the media page are counted as neutral answers and excluded from the analysis as well.

<<< insert Table 1 about here >>>

The predictions of actual answers given by participants based on gaze measures were calculated individually for every media page and the measures first fixation, duration of fixation and number of visits. The AOI which was dependent on the measure analyzed either, the first fixated, the longest fixated, or the most frequently visited, was declared the expected answer. The expected answers were compared to the actual answers given. In Figures 3 and 4 the shares of correct predictions made per participant for every question, based on all three measures are

[1] The media pages 10 (for BCG), 34, 35 and 36 (for BMC) for stimuli version 1 and media pages 20 (for BCG), 26, 27 and 28 (for BMC) for stimuli version 2, qualify for that definition. The media pages are available upon request.

accumulated. The results do not indicate a normal distribution. Therefore, an association between the expected and the actual answers given exists. Based on the data, this association seems to be positive, due to the majority of participants who have a share of correct predictions above either 33% or 50%. A one sample t-test supports this assumption, since for both three answer options ($t(88) = 7.63$, $p < 0.001$) and two answer options ($t(69) = 4.46$, $p < 0.001$), the consistency of correct predictions per participants are significantly different compared to the expected values of 0.33 and 0.5.

<<< insert Figures 3 and 4 about here >>>

To reflect upon the detailed results of the strength of predictions possible, only the strongest measure is presented in this chapter. This measure is the number of visits. After calculating the number of visits of every participant in the relevant AOIs, those numbers were divided by the individual time required. This way, the effect of different total time requirements amongst the participants was eliminated. The AOI, which was visited the most frequently in percentage of the total time required, was named the expected answer. The correlations between expected and actual answers given are displayed in Table 2.

<<< insert Table 2 about here >>>

Overall clearly positive correlations prevailed with significant correlations on media page 10 for Answer 1 ($r(43) = .60$, $p < 0.01$), Answer 2 ($r(43) = .46$, $p < 0.01$) and Answer 3 ($r(43) = .33$, $p < 0.05$), on media page 20 for Answer 1 ($r(46) = .42$, $p < 0.01$), Answer 2 ($r(46) = .50$, $p < 0.01$) and Answer 3 ($r(46) = .35$, $p < 0.05$) and on media page 27, Answer 1 ($r(13) = .63$, $p < 0.05$) and Answer 2 ($r(13) = .77$, $p < 0.01$). Further, the predictive value of the number of visits is very high (see Table 3). With three answering options, the AOI, which was visited the most frequently, was predicting the actual answer given in 73% of the cases. If there were only two different answer options, even 76% were predicted correctly. One sample t-tests were carried out to evaluate the significances of these results. Both for the three answer options with the expected value 0.33 ($t(88) = 8.46$, $p < 0.001$) and two answer options with the expected value 0.5 ($t(104) = 6.27$, $p < 0.001$), the results show significant differences to the random distribution. Thus, Hypothesis 1 is supported by our data. The decisions made by the decisions maker are indeed predictable based on the gaze data. Especially a frequently visited input area can have a strong impact on the actual decision made. Hence, an association between gaze behavior of decision makers and cognitive processing of strategy tools exists.

<<< insert Table 3 about here >>>

Hypotheses 2 and 3 ask the question, if the calculated predictions in Hypothesis 1 are dependent on certain aspects of the tools. First, does a different display of the same strategy tool with the same content influence the predictive value of the elected measures? For this, we focus on the questions regarding the BCG and compare the accuracy of the predictions from both versions of the stimuli. All three measures were compared in between stimuli version #1 and #2. The difference between the two stimuli versions is the orientation of the X-axis. An independent sample t-test was carried out to evaluate potential significant differences in the accuracy of the prediction between the two samples. The detailed results are displayed in Table 4.

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The differences between the sample sizes are clearly insignificant for all measures, including the first fixation ($t(87) = -0.94$, $p = 0.35$), the duration of fixation ($t(87) = 0.29$, $p =$

0.77) and the number of visits (t(87) = 0.06, p = 0.95). Hence we reject Hypothesis 2. The different depiction styles of strategy tools seem to not influence the accuracy of prediction of the gaze measures. Furthermore, Hypothesis 3 analyzes the impact of different amount of information given to the decision maker. For the analysis of this Hypothesis, the two different versions of the BMC were used. Similarly to the procedure applied to Hypothesis 2, the significance of the differences in the predictive value of all three measures were elected. The results are displayed in Table 5.

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There are also no significant differences between the accuracy of the predictions of both samples of the BMC. All of the measures used, including the first fixation (t(103) = -0.64, p = 0.53), the duration of fixation (t(103) = -0.74, p = 0.46) and the number of visits (t(103) = -.054, p = 0.59), indicate that there is no significant difference in the predictive value between stimuli #1 and #2. Hence, we reject Hypothesis 3. The amount of information given in a strategy tool do not influence the predictive value of the gaze of decision makers for the actual decision made.

5. Discussion

Discussion of results. This study is the first to use the eye-tracking method in the field of strategy tools. Using this method, the individual interpretation of applied strategy tools was investigated, as suggested in literature (Knott, 2006; Spee and Jarzabkowski, 2009). The authors focused primarily on task-relevant looking (Kahneman, 1973) and made predictions about the actual decision made by decision makers, based on their gaze behavior. The measures used were the first fixation, the duration of fixation and the number of visits. Those measures were compared on the media pages amongst participants which made a decisive decision between multiple displayed areas. The measure number of visits is the strongest predictor of the actual decisions. However, also the other two selected measures render significantly better predictions compared to the random distribution. Using the measure first fixation, 47% of the answer with three answer options ($t(88) = 2.66$, $p < 0.01$) and 65% of the answers with two answer options ($t(104) = 3.15$, $p < 0.01$) were predicted correctly. The results of the predictions are displayed in Table 6. Hence, decision makers have also a tendency to decide for the input they fixated first.

<<< insert Table 6 about here >>>

As mentioned above, the predictions are also significantly better compared to the random distribution for the measure duration of fixation. With this measure, 67% of the answers with three answer options ($t(88) = 6.88$, $p < 0.001$) and 75% of the answers with two answer options ($t(104) = 5.96$, $p < 0.001$) were predicted correctly. The results of those predictions are displayed in Table 7. Decision maker have hence also a tendency to decide for the input are they fixated the longest total of time in percentage of overall time required.

<<< insert Table 7 about here >>>

The results found with the measures first fixation and duration of fixation further support our decision to support the association between cognitive processing and gaze behavior on strategy tools. Eye tracking is hence capable of revealing important aspects of the individual interpretation of strategy tools by decision makers. The authors promote eye tracking as a valuable method in strategy tools' use in practice and research.

Furthermore, the analysis of Hypothesis 2 showed that there are no significant differences in the predictability of the answers given in the BCG for both stimuli version #1 and #2. The difference between the two versions was a mirrored X-axis. The number of correct and wrong predictions were fairly similar in both versions. Hence the fundamental design measures of a strategy tool seems to not influence the visibility of the information processing by decision makers. Hypothesis 2 is therefore rejected. Similarly, the differences between the two versions of the BMC also did not significantly influence the predictive value of the gaze measures. The difference in the BMC was a different level of complexity due to the amount of information given. Hypothesis 3 is thus also rejected. The visibility of the information processing by decision makers of strategy tools seems to not be affected by the complexity of the tool used. The rejection of both Hypothesis 2 and 3 suggest that similar findings could be achieved by using different models compared to the two strategy tools used in this study. The insights created based on the BCG and BMC seem to be valid for the broader range of strategy tools. This however needs to be further solidified by future research.

Practical implications. This paper provides important implications for practice. We consider for practice both the actual use of strategy tools in organizations and workshops as well as the teaching of strategic management. The low satisfaction with strategy tools in practice (Rigby, 2001, 2013) requires methods to analyze the reasons for the shortcomings of strategy tools more in depth. The results provided in this paper suggest eye tracking as a viable method for creating additional comprehension. Due to the strong association between the collected gaze data and the actual decision making of the decision maker, insights into the information and thought process of every individual decision maker are made available. This way, the cause of different meanings (Grant, 2003; Salih and Doll, 2013) based on identical strategy tools can be analyzed. We advice practice to be aware of the implications of different gaze behavior on the interpretation of information in strategy tools. This awareness can guide practice to achieve shared meaning. Practicing managers can use eye tracking to evaluate which aspects of the tools are perceived most important and where their main focus of interest lays

(Rayner, 1998). If those focus are widely different for certain clusters of employees, they are able to predict the different reasoning that could arise later in the implementation process of the tool. The managers have to make sure to identify such threats of different meaning beforehand and bring everyone on the same page about the implications of the tool in use. Similarly, lecturers in educational institutions can use eye tracking to evaluate the areas which are harder to cognitively process for the students (Findlay and Gilchrist, 1998; Just and Carpenter, 1976). This way, possible deficiencies in teaching or in the creation of strategy tools can be revealed and analyzed more in depth.

Limitations and future research. We used three different gaze measures to evaluate the predictability of tool-based decision-making of decision makers. The measures used were the first fixation, the duration of fixation and the number of visits. The results indicated that all of those measures can generate insights into the decision-making process of the decision maker and establish eye tracking as a valuable method for the analysis of individual interpretation of strategy tools. However these results are subject to certain limitations. First of all, only two strategy tools were examined in the experimental design. Hence, the BCG portfolio matrix and the Business Model Canvas are used as proxies for the wider range of strategy tools. This limitation was narrowed to a certain extent by the use of two different stimuli versions. Second, the participants did not receive any top-down support by the conductor of the testing procedure. 94% of the appliers of strategy tools in practice think that this top-down support is necessary to successfully use a strategy tool (Rigby, 2001). Hence, the participants of this study were not provided with the ideal initial position to succeed and learn the application of the strategy tools efficiently. Third, all used measures of this study were dependent on the definition of AOIs. Those areas have to be drawn and defined before being able to quantitatively analyze the data. Hence, the definition of AOIs can be arbitrary and may not be grounded in literature (Purucker et al., 2013). The authors narrowed this limitation by covering all fields containing any form of information with an AOI. The AOIs linked to answer options on media pages featuring questions were then analyzed in depth. Lastly, the segmentation and partly the exclusion of certain recordings with bad sampling rates or neutral answers led to relatively small sample sizes. This is a limiting factor for the significance of the quantitative analysis.

This paper established eye tracking as a valuable method in strategy tool research. The study presented here focused largely on task-relevant looking. Future research could use a different experimental setting, focusing on the learning and reading of an applied strategy tool. Also, a similar research design compared to this study could be used with different samples and different stimuli to further establish the eye tracking method in the field. The tools used by an organization could be analyzed using eye tracking to assess aspects of the gaze, such as the different gaze patterns (sequence of fixations on an interface) or the duration of fixations on different information inputs given, by the employees of the organization. Identified differences could further be analyzed to better understanding the reason for not established shared meaning in the organization based on a tool. Further regarding the sample, mainly current business students were tested. Hence, this sample does not necessarily represent the broad population of strategy tool users. Future research could further support the results presented in this paper using different sampling. Lastly, the analysis of gaze behavior in more dynamic environments of strategic management, such as workshops could be further analyzed. For that, the use of portable eye tracking glasses is recommended by the authors. This approach would be similar to the research provided by Paroutis et al. (2015).

6. Conclusion

As suggested in literature, this paper further elaborated on the individual interpretation of users of strategy tools instead of the usual textbook-approach (Knott, 2006). The research in this paper focuses on the gaze of decision makers and its influence on decision-making. This is the first application of the eye tracking method in the field of strategy tools. The authors set out to "tell people how they decide" based on "how they gaze at strategy tools". Using different gaze measures, the authors are indeed able to predict the answer given based on the gaze data in up to 76% of the decisions. This high predictive value of the selected gaze measures supports the strong link between the gaze and cognitive processing of strategy tools by decision makers. Hence, practice is provided with insights on the importance of the gaze of users of strategy tools on individual interpretation. Ideas are provided on how organizations can use eye tracking to create shared meaning and improve their satisfaction with the used strategy tools. The authors hope to spur additional research on other aspects of the interpretation of strategy tools by users and contribute towards the creation of design and application principles of strategy tools.

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Figures

Figure 1: Conceptual model

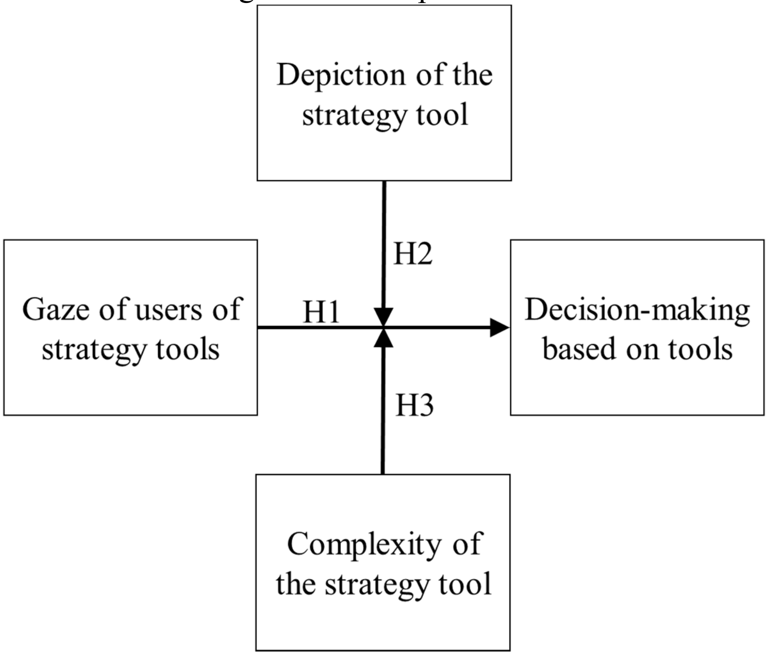


Figure 2: Layout of the lab for eye-tracking research

Figure 3: Prediction consistency, three answer options
All measures accumulated, n = 89

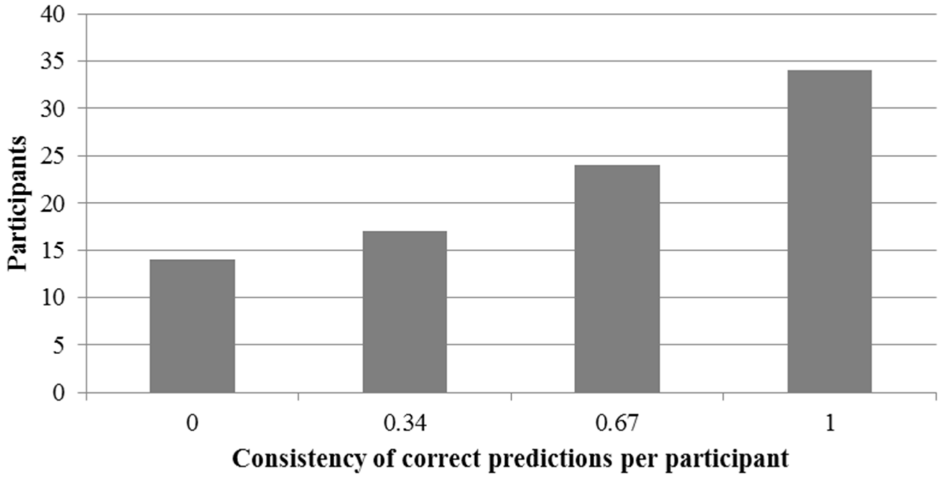
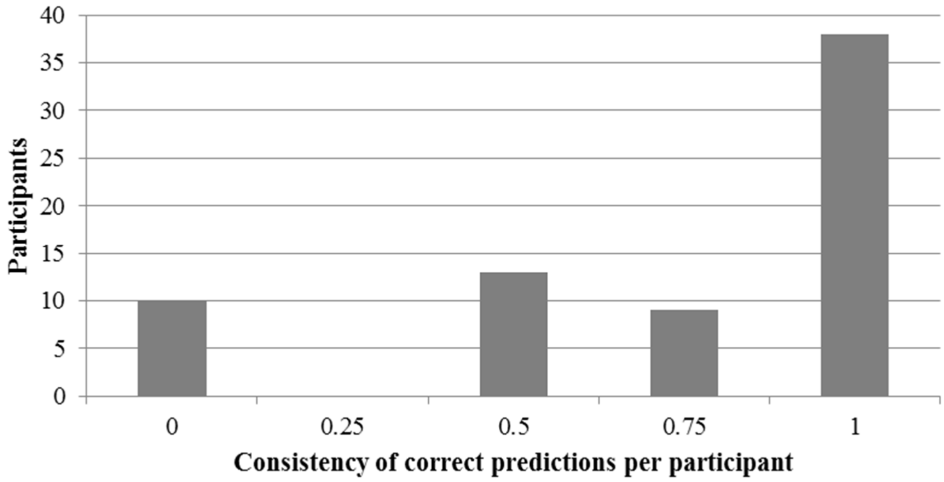


Figure 4: Prediction consistency, two answer options
All measures accumulated, n = 70



Tables

Table 1: Number of predictions made

Media page	Total answers	Neutral answers	Blind answers	Valid predictions made
10	45	0	2	43
20	46	0	0	46
26	46	22	2	22
27	46	26	7	13
28	46	25	9	12
34	45	21	3	21
35	45	25	4	16
36	45	21	3	21
Total	**364**	**140**	**30**	**194**

Table 2
Correlations expected and actual answer
Measure: Number of visits

	S1		S2	
Exp. answer	Media page	ϱ	Media page	ϱ
Answer 1	10	.596**	20	.427**
Answer 2		.456**		.497**
Answer 3		.332*		.350*
Answer 1	34	.097	26	.400
Answer 2		.386		-.133
Answer 1	35	.149	27	.632*
Answer 2		.479		.765**
Answer 1	36	.104	28	-.086
Answer 2		.346		.177

* p < .05
** p < .01

Table 3
Predictor calculation, number of visits
Three decisive answer options

Stimuli Version	Media page	N correct	N wrong	% correct
S1	10	31	12	72.1
S2	20	34	12	73.9
Combined		65	24	73.0

Two decisive answer options

Stimuli Version	Media page	N correct	N wrong	% correct
S1	34	14	7	66.7
	35	12	4	75.0
	36	17	4	80.1
S2	26	15	7	68.2
	27	11	2	84.6
	28	11	1	91.7
Combined		80	25	76.2

Table 4
Impact of X-axis orientation on predictions
Independent Samples t-Test

Measure	Df	t-value	Sig.
Time to first fixation	87	-.944	.348
Total time of fixation	87	.297	.767
Number of visits	87	.064	.949

* p < .05
** p < .01

Table 5
Impact of complexity on predictions
Independent Samples t-Test

Measure	Df	t-value	Sig.
Time to first fixation	103	-.637	.526
Total time of fixation	103	-.740	.461
Number of visits	103	-.544	.588

* p < .05
** p < .01

Table 6
Predictor calculation, first fixation
Three decisive answer options

Stimuli Version	Media page	N correct	N wrong	% correct
S1	10	19	24	44.1
S2	20	23	23	50.0
Combined		42	47	47.2

Two decisive answer options

Stimuli Version	Media page	N correct	N wrong	% correct
S1	34	11	10	52.4
	35	10	6	62.5
	36	15	6	71.4
S2	26	10	12	45.5
	27	12	1	92.3
	28	10	2	83.3
Combined		68	37	64.8

Table 7
Predictor calculation, longest fixation
Three decisive answer options

Stimuli Version	Media page	N correct	N wrong	% correct
S1	10	30	13	69.8
S2	20	30	16	65.2
Combined		60	29	67.4

Two decisive answer options

Stimuli Version	Media page	N correct	N wrong	% correct
S1	34	15	6	71.4
	35	11	5	68.8
	36	16	5	76.2
S2	26	14	8	63.6
	27	12	1	92.3
	28	11	1	91.7
Combined		79	26	75.2